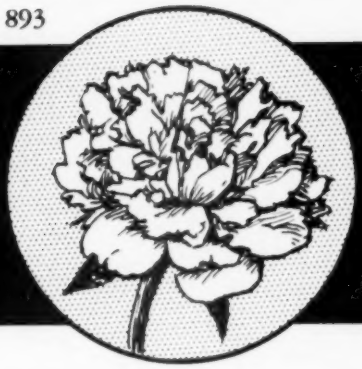
CORNELL EXTENSION BULLETIN 893

PEONY CULTURE



R. E. LEE

THIS bulletin is concerned with the commonly grown garden peonies, *Paeonia lactiflora, P. officinalis,* and *P. tenuifolia.* Other species sometimes planted include the tree peonies, such as *P. suffruticosa* and *P. lutea. P. lutea* is one of the few species that has yellow flowers.

The hardiness, the comparative ease of culture, and the permanent nature of a peony planting combine to make this flower one of the most valuable herbaceous perennials for gardens. The colors range from white through all shades of pink to the darkest red, and the lasting quality of the cut flower make the peony especially valuable for decorative purposes. The showy flower and the attractive foliage which remains in good condition all season, in some varieties turning bronzy red in autumn, give the plant definite landscape value. You may use the plants as a background for other flowers or for a herbaceous hedge effect.

Types of Peonies

FOUR main horticultural types of the garden peony (*Paeonia lactiflora*) have been established by the American Peony Society: the single, or Chinese; the Japanese, the anemone, and the double types. The *single* or *Chinese* type has a flower with five or more true petals and a center of pollen-bearing anthers. The varieties Scarf Dance and Pride of Langport are examples of this group. The *Japanese* type, illustrated by the varieties Mikado and Mme. Butterfly, has five or more large guard petals and a center made up of stamens bearing abortive anthers with practically no pollen. The *anemone* type is similar to the Japanese but has no anthers; the filaments of the stamens have been transformed into narrow, incurved petal-like parts. Examples are the varities Philomele and Primevere. In the *double* type the stamens and the stigmas have become petaloid, giving a fully double flower. Several varieties in this group are listed on page 4.

Site and Soil

THE culture of the peony is relatively simple. The plant thrives in practically all types of garden soil, but grows best in a rich garden loam. The soil must be well drained and retain adequate moisture during the flowering season of the plant. The plants need plenty of sunlight. Peonies will not do well in shade or in low areas that become waterlogged. Peonies planted in shade are more subject to diseases than when in full sun.

Planting

SET out new plants as soon as you receive them from the nursery, generally between September 1 and October 15. You may move the plants in the garden at this time also. In heavy clay soils, deep preparation of the soil before planting is important. This improves the drainage and permits you to add organic matter, such as well-rotted manure, compost, leaf mold, or peat moss.

In planting, set the roots or toes so that the new eyes or buds at the base of each stem are about at the level of the surface of the soil. If you bury these buds with more than 2 inches of soil, the plants will not be thrifty and may fail to bloom. Dig the hole large enough to allow the roots to spread out as they naturally grow. Firm soil about the roots and water the planting thoroughly. Dwarf varieties may be set 2 feet apart when the plants are intended to form a compact row or hedge effect. For the vigorous-growing Japanse type and the large spreading double-flowered peonies, 4 feet apart is not too much.

Fertilizing

PEONIES respond to liberal fertilization. Fertilizers may be applied just after the blooms have faded in early summer. A handful of a 5-10-5 or 10-10-10 commercial fertilizer worked into the soil about each plant is adequate. You may make yearly applications of well-rotted manure in the fall of the year and then work it into the soil the following spring. Never use fresh manure, for it is injurious to the peony roots.

Cultural Practices

ALTHOUGH peonies survive under competition with weeds better than most plants, clean cultivation is the best practice. Thoroughly weed the bed and cultivate it in early spring, then remove weeds whenever necessary. A heavy mulch of sawdust or some other material helps to keep down weeds.

If you grow peonies for exhibition, you may disbud them early in the season. Allow one bud to develop on a stem. This eliminates inferior buds and produces larger flowers.

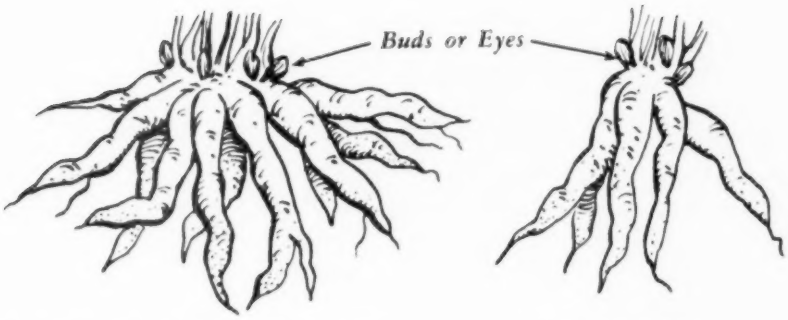
When the flowers have faded, remove the developing seed pod and the flower stalk. In the fall when the frost has killed the foliage, cut off all stems close to the ground and burn them.

Staking

STAKE any weak-stemmed plants when they have attained a growth of 15 inches. Staking prevents the weight of the large double-flowered types from bending the stems to the ground. You may use forked branches to prop up the heavy large-flowered types, or you may circle the plant with a hoop of wire or string connected to three or four stakes. With either method, be sure the stakes are as inconspicuous as possible.

Propagation

PEONIES grow so slowly from seed that it takes several years for seedlings to flower. With this method of propagation, it is customary to use the laboratory technique of excising the



An 8-year old clump of roots that needs to be divided

The new division

embryos and growing them on a nutrient agar medium under aseptic conditions. The usual method of propagation is to divide large clumps.

If old established plantings fail to flower satisfactorily, divide the clumps. Generally, peonies should be divided about every five or six years. The most favorable time to divide or transplant established plants is from September 1 to October 15. Divide large clumps of roots into sections so that there are at least three eyes or buds on each clump of roots (or toes) of the new division. These should provide flowering plants for the following season. During the first winter after the plants have been transplanted or divided, apply a light mulch of straw, manure, evergreens, or some other material as soon as the ground freezes. Remove the mulch the following March.

Failure to Bloom

A PEONY planting may fail to bloom for one or more of the following reasons:

1. Old choked plants need to be divided
2. New plants were too recently planted
3. Divisions were too small
4. New plants were planted too late in the season, or divisions of old plants were made too late in the fall
5. Plants were set too deep
6. Buds blasted due to a late freeze in the spring
7. Botrytis blight or Phytophthora blight attacked the plants

Diseases

SYMPTOMS of the Botrytis and Phytophthora blight are similar. Young shoots may wilt suddenly and collapse. A soft, light brown rot may develop (Botrytis) or diseased tissues may be dark brown to black in color and of a leathery texture (Phytophthora). Small buds when attacked may cease growth and turn black. A bud blast similar in appearance may be due to a late freeze, to poor vigor of the plants, or to too deep planting.

Clean culture is the best way to control either of the blight diseases. Cut

to the soil line all rotted or wilting shoots, leaves, or buds, and burn them. This prevents overwintering of the disease on the old foliage. If the plants attacked by the blight are in a shaded or semi-shaded area, remove them to a situation in full sun. Several applications of bordeaux spray to the new shoots in early spring may help to combat these blights.

Ants are commonly found on peonies. As far as is known these ants cause no direct injury to the flowers.

Varieties

THE American Peony Society maintains a rating scale of all registered peonies. A few of the higher rated varieties in each of several types are listed according to color, season and official rating in the following table. The rating is based on a scale from 1 to 10, with 10 the highest.

White and Light Colors

Early	*Mid-Season*	*Late*
Festiva Maxima 9.3	Baroness Schroeder 9.1	Elizabeth Barrett Browning 9.2
Mons. Jules Elie 9.2	Francis Willard 9	Lady Alexandra Duff 9.1
	Kelways Glorious 9.8	Solange 9.7
	Le Cygne 9.9	Tourangello 9.4

Pink and Medium Colors

Early	*Mid-Season*	*Late*
Le Fee 9.2	Loveliness 8.8	La France 9.0
Martha Bullock 9.1	Mme. Jules Dessert 9.4	Milton Hill 9.0
	Marie Grousse 8.9	Raoul Dessert 9.0
	Rosa Bonheur 9	Sarah Bernhardt 9.0
	Therese 9.8	Walter Faxon 9.3

Red and Dark Colors

Early	*Mid-Season*	*Late*
Mikado 8.6	Longfellow 9.0	Felix Crousse 8.4
Phillipe Revoire 9.2	Mary Brand 8.7	Karl Rosenfield 8.8
Richard Carvel 8.8	Mons Martin Cahuzac 8.8	

A publication of the
New York State College of Agriculture,
a unit of the State University of New York,
at Cornell University

Published by the New York State College of Agriculture at Cornell University, Ithaca, New York. L. R. Simons, Director of Extension. This bulletin is published and distributed in furtherance of the purposes provided for in the Acts of Congress of May 8 and June 30, 1914.

CORNELL EXTENSION BULLETIN 894

The Culture of Garden Chrysanthemums

R. E. LEE

Types of Flowers

THIS bulletin is concerned with the chrysanthemums that bloom in the garden in late summer and fall. Through hybridization the garden varieties have been greatly improved, particularly by the introduction of the Korean strain which gives increased hardiness.

Several types are grown in the garden. The *fully double type* has large flowers that usually measure at least 3 inches in diameter. The flower has many rows of ray florets ("petals"), and no center of disc florets or eye is visible. The *single* chrysanthemum has one to five rows of ray florets and a prominent central disc or eye. The *duplex* is intermediate between the single and the double. It has more than five rows of ray florets and a definite eye of disc florets. The *anemone* type has one to five rows of ray florets and a cushion of slightly enlarged and expanded disc florets, often with the same coloration as the ray florets. The *pompon* has small, well-rounded, fully double flowers that may vary in size from the miniature button type to the larger ball types, and are borne on well-branched sprays. Other variations less commonly seen in gardens include such novelties as the *thread, spoon,* and *quilled* types. The so-called *cushion mum* is a dwarf, dense plant of mound-shaped habit of growth, which rarely exceeds 1 foot in height. When in flower, the blossoms practically obscure the foliage. They are useful as edging plants and for general use in the foreground of a border.

There are many hundreds of named varieties in the trade. Development of new varieties is so rapid and turnover so great that one year's varieties are soon superceded by newer ones. Hence there is little practical advantage in listing selected named clones currently available. Catalogues of chrysanthemum specialists should be consulted for lists of plants in the various color ranges and heights, as well as for early, mid-season, and late-flowering varieties, disease resistance, and the like.

Site for Planting

CHRYSANTHEMUMS thrive in well-drained garden loam which is slightly acid in reaction and supplied abundantly with organic matter in the form of peat, leaf mold, well-rotted manure, or compost. Peat is an advantage in neutral or alkaline soil. The plants thrive in full sun but satisfactory results may be obtained in

semi-shaded situations where the plants receive full sunlight for at least six hours a day.

Soil Preparation and Fertilizing

IN preparing a bed for chrysanthemums you may mix about 4 pounds of 5-10-5 or some similar fertilizer into the soil for each 100 square feet of garden space. Soil that contains abundant organic matter needs no more fertilizer during the season. On poor soil you may make a second application of fertilizer as a side-dressing in early August at the rate of 2 pounds of fertilizer to 100 square feet of garden surface. Water the fertilizer in. During the growing season, keep the soil moist at all times. A mulch of peat moss or other materials helps to retain moisture.

Planting and Propagation

CHRYSANTHEMUM plants purchased from the commercial producer arrive during May or early June. These are either rooted cuttings as shown in figure 1 or cuttings grown for some time in soil to give increased development. As soon as possible set these plants 10 inches apart in the garden. To obtain the best effect, group three or more plants together in the border.

You may dig up and divide in early spring clumps that bloomed the previous fall and overwintered in your garden. You may also separate vigorous plants into single stems with enough roots to warrant transplanting. Less vigorous plants should be divided so that three growing points or stems remain in each of the new divisions (figure 2).

You may leave overwintering clumps in position and thin out the shoots to 8 to 10 inches apart. It is usually better practice, however, to dig out the old clumps and reset new divisions.

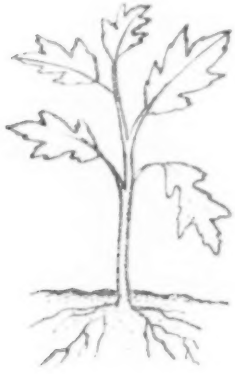


Figure 1. Single stem division of vigorous clump.

Figure 2. New division from less vigorous plants.

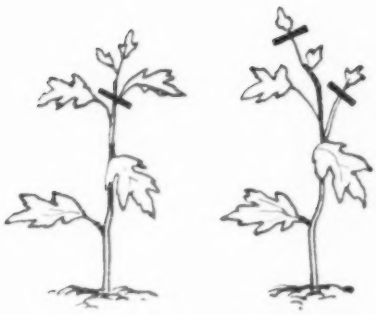


Figure 3. Straight lines indicate points where shoot tips should be pinched off.

Pinching

AN important practice in growing chrysanthemums is to pinch out the terminal growing point or shoot when the plant is 5 or 6 inches tall. This causes the plant to send out lateral branches. When these laterals are 5 or 6 inches long, pinch out their tips. Pinching in this way makes a spreading bushy plant with an abundance of bloom. The practice is illustrated in figure 3. After July 15 no further pinching is desirable. If you want fewer and larger blooms, with longer stems, do less pinching. Disbud to 1 bud a stem, and pinch out all side shoots, if you plan to exhibit flowers.

Flowering

CHRYSANTHEMUMS normally flower after the days become shorter in August and later. To make them flower in advance of the normal season or to make late-flowering varieties flower before freezing weather, cover the plants with black cloth at 6 p. m. and remove it at 7 a. m. each day, starting in late July and continuing until September 1. Cold nights prevent buds from forming and inhibit bud growth so that in many parts of New York State chrysanthemums do not bloom satisfactorily unless given short days early in the summer before the nights get cool. In these areas it is imperative that you plant early flowering varieties. It may be said that chrysanthemums flower best in a climate where muskmelons mature consistently.

Insects and Diseases

SEVERAL pests and diseases attack chrysanthemum plants. *Mildew* may be partly controlled by dusting with sulfur, while *leaf spot* may be prevented by spraying regularly with a fungicide containing Ferbam. The *wilt* which may affect chrysanthemums is best prevented by growing varieties that are not highly susceptible; there is no cure.

Keeping the foliage as dry as possible cuts down the damage from leaf spot and *nematodes* which are most troublesome during wet seasons. Thick mulches applied early in the season also help to reduce the damage from these troubles.

Some of the more troublesome insects, such as the *four-lined plant bug*, can be controlled by dusting the plants with 5 per cent DDT or spraying with 50 per cent wettable DDT, 1 tablespoonful per gallon. Some of the available spray and dust mixtures contain both Ferbam and DDT and are satisfactory (Protexall, J. & P. Rose Spray and Dust, ACP Rose Spray

and Cross Country Garden Dust are examples). If the damage is serious and you do not know the cause, send a specimen to the Department of Plant Pathology or the Department of Entomology, Cornell University, Ithaca, New York, for diagnosis.

Hardiness

CHRYSANTHEMUMS in general are not regularly hardy, and greenhouse varieties rarely survive the first winter if planted out-of-doors. Many varieties can withstand quite low temperatures, but it is the fluctuating temperature with alternate freezing and thawing during the winter that causes most of the winter injury. A mulch of the ordinarily used materials, such as leaves or straw, is not suitable because it excludes light which is essential to normal functioning of the basal leaves. Glass wool is a satisfactory mulch if you can get it. You may use hemlock or spruce branches to cover the plants and add a light covering of salt hay after the ground is frozen. Plants usually come through the winter as well with no mulch at all as with the materials usually used. Winter damage is less on well-drained soils than on those poorly drained. The single-flowered variety Clara Curtis *(Chrysanthemum rubellum)* can usually be depended upon to be completely hardy.

A publication of the
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Published by the New York State College of Agriculture at Cornell University, Ithaca, New York. L. R. Simons, Director of Extension. Published and distributed in furtherance of the purposes provided for in the Acts of Congress of May 8 and June 30, 1914.

CORNELL EXTENSION BULLETIN 895

THE CULTURE OF IRIS

L. H. MacDANIELS

Kinds of Iris

THE genus *Iris* includes about 170 species. The many diverse types are commonly classified as bulbous or rhizomatous. The latter are further divided into other groups, the most important of which from the standpoint of northern gardens are the *bearded* or *German iris (Pogoniris)*, most frequently planted, and the *Japanese iris* and the *Siberian iris*. The bearded and Japanese iris are represented by many hundreds of named varieties or clones of varied color and habit.

Soil and Site

THE culture of iris is relatively simple as compared with that of many other garden plants. All require a sunny location, particularly the bearded types. For the German iris, any good garden soil is suitable provided it is well drained. The Japanese iris thrives on moist rich soils and may be planted with success around pools. It will, however, do well in other situations if the soil is fertile and abundant moisture is supplied. The Siberian iris is hardier than either of the others both in withstanding severe climatic conditions and in withstanding the competition of other plants.

Propagation of Iris

IRIS, except the bulbous types, are propagated by simple division of the rhizomes. The divisions of the *bearded iris* are called *fans* and consist of one of the fan-like clusters of leaves with a section of the attached rhizomes about 2 to 3 inches long. The plants are usually divided in early July just after they bloom. In the garden the individual fans may be dug and separated or the clump may be cut into sections of several fans each with a sharp spade. It is good practice to cut off one-half or two-thirds of the leaf surface at the time of transplanting unless a clump is moved with a ball of earth. Divisions set in July will form roots and new growth before winter.

Japanese and *Siberian* iris may be divided best in early spring before growth starts. Later divisions during the spring and early summer can be made, but plants are more difficult to establish. Fall division is not satisfactory because of the danger of the plants heaving out of the ground during the winter. The clumps are dug up and cut into divisions with a heavy knife or sharp spade. Each division should have several tufts of leaves and as many roots as can be left attached in the process of cutting.

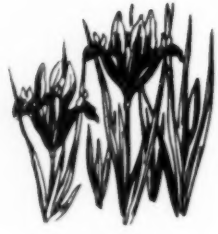
Planting

THE established rhizomes of the *bearded iris* normally lie at the surface of the soil about half embedded in the earth. In planting, they should be covered with about 1 inch of soil and the earth packed solidly about them. As they become established they will grow to the surface. The other types of Iris should be planted with the roots well spread and covered with about 2 inches of well-firmed earth.

To maintain the bearded iris in good blooming condition in the garden it is desirable to divide the clumps every third or fourth year. A fan set in July may send up flower stalks the following year. The clumps will increase the second year, and the third year the clumps will be at their best. In the fourth and fifth years the fans compete with one another and should be thinned out by removing a part of the fans so that they are spaced several inches apart or by digging up the clump, dividing it, and resetting the rhizomes. Usually it is necessary to dig up the clump, and divide and reset it because of infestation of the clump with grass and weeds. If in overhauling the Iris bed it is desired to establish new flowering clumps rapidly, 3 or 4 of the fans may be set together to form a clump. In setting such clumps the leafy end of the rhizomes should be set pointing outward from the center of the new clump.

Japanese and *Siberian* iris do not require frequent division. Clumps of Siberian iris remain in good condition for a dozen years or more. Sooner or later, however, the size and quality of the blossoms may deteriorate or they may become infested with borers or overgrown with grass and will benefit by division and replanting.

Some Types of Iris



Reticulata

English Iris

Tall Bearded

Fertilization and Maintenance

THE *bearded iris* will grow on relatively poor soil. On poor soil, however, plants will benefit from the use of a good garden fertilizer, such as a 5-10-5 formula, dug into the soil around the plants in early spring or just after they have bloomed. A small handful (⅓ cup) to a clump spread on the surface of the ground several inches from the base of the plant and mixed with the soil is satisfactory.

Weeds should be controlled by clean cultivation and pulling from among the rhizomes. Various kinds of grass are the most troublesome because they grow between the rhizomes and are difficult to remove. It is an advantage to have the plants free from grass, weeds, or other crowding vegetation so that the foliage and the rhizomes will not remain moist over long periods of time and thus favor the spread of fungus disease. Borer infestation is also favored by weedy plantings.

An important practice in the culture of the *bearded iris* is to clean up and burn all dead foliage, preferably in the fall. This foliage carries disease spores and insect eggs. Winter protection through most parts of New York State is unnecessary. Only in the most severe winters is there any severe damage and then only when the plants are exposed without snow cover. A loose mulch of coarse straw or litter may be an advantage, provided it does not mat down on the rhizomes and keep them wet. Mulches afford cover for mice which may destroy the rhizomes. A mulch may be advisable if the iris plants have been planted in the fall and are not yet well rooted.

Japanese iris thrives under more moist conditions than does the bearded type and also responds to more liberal applications of fertilizer. Either well-rotted manure or a commercial 5-10-5 fertilizer is valuable when placed around the plants in early spring and mixed with the soil. Peat or compost is useful in soils that lack organic material. If the weather in June before the plants bloom is dry, liberal watering is advisable. Cultivation is essential to keep down weeds although the danger of disease is apparently not so important as with the bearded iris. The growth of the Japanese iris clumps is relatively slow, but they should be divided occasionally as they become crowded.

Siberian Japanese

Siberian iris are perhaps the easiest to grow of all. Once established they persist in spite of competition from weeds and grass. They do, however, respond to good garden culture, and clumps that become over-size should be divided and the divisions reset.

The Bulbous Iris

THE *bulbous iris* are most adapted to a climate with hot, dry summers and mild winters. Of the many species only a few are satisfactory for growing in the Northern States and these are not well known to gardeners. In the very early spring the dark purple flowers of *Iris reticulata* are attractive in the garden. Another hardy, early blooming species is the sky blue *I. histrioides*. The later blooming Spanish iris, *I. Xiphium,* is more showy and a good garden subject. The English iris, *I. xiphioides,* is larger, later, and comes in a variety of attractive colors. The Dutch iris of which the common greenhouse forcing variety Wedgewood is an example is a hybrid race not satisfactory in northern gardens.

The above named bulbous iris are easy to grow in well-drained soils in the open. They should be planted from 3 to 4 inches deep, and spaced 6 inches apart under good conditions. The bulbs multiply naturally by division and may be dug and separated at intervals of several years.

Insects and Diseases

THE *bearded iris* is subject to a number of diseases including leaf spot and soft rot. Early and repeated spraying with a zineb-containing fungicide helps to control the former. Rhizome rot may be related to damage caused by iris borers and to allowing the clumps to become crowded and weedy. Clean cultivation, sunshine, and removal of dead foliage in the fall and early spring will do much to keep the plants healthy.

The iris borer is the most troublesome insect. Early season weekly application of DDT dust or spray is a good control. Both zineb and DDT are included in available spray and dust mixtures that are satisfactory if applied as directed on the package. (Dithane-Z-78, Parzate and Dupont Fungicide A are examples.)

If special problems arise, inquiry may be made to the Department of Plant Pathology or the Department of Entomology, New York State College of Agriculture, Cornell University, Ithaca, New York, for specific information on disease and insect control.

Because of the number and diversity of species and forms of Iris, the culture of this genus makes an interesting hobby. The American Iris Society, which is concerned with this group of plants, can be reached through its Secretary, Geddes Douglas, Franklin Road, Brentwood, Tennessee.

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CORNELL EXTENSION BULLETIN 896

The Culture of Spring Flowering Bulbs

R. E. LEE

HARDY bulbs exceed all other groups of plants in producing color in the spring garden. For the most part they are the earliest plants to bloom and most of them have exceptionally showy flowers. The gardening season begins with the snowdrops and winter aconite, usually in early March. These are soon followed by Crocus, Scilla, and Chionodoxa; then come the hyacinths, daffodils, and tulips. Bulbs are also a most versatile group of plants in that there is some type for any location. Attractive mass plantings may be made in solid beds, to be followed in June by annuals. Groupings may be spotted about in a perennial border or rock garden. Bulbs are attractive along paths and walks, or planted around pools, or placed in front of foundation plantings around the home. Most spring bulbs, with the exception of tulips and hyacinths, may also be effectively naturalized.

Site

MOST bulbs do well the first year regardless of where they are planted. Very few do well for several years unless they have a fair amount of light and generally favorable growing conditions. Planting bulbs beneath large trees is seldom satisfactory because of the dense shade cast by the trees and the competition with tree roots. *Scilla sibirica, Crocus,* winter aconite, and snowdrops *(Galanthus)* will, however, give satisfactory performance under trees.

Very few of the hardy spring-flowering bulbs tolerate wet, soggy soil conditions during winter. Put them in a situation where there is good drainage and where there is no danger of water standing on the surface of the ground through the winter or spring. Camassia is an exception and will do well in wet, almost swampy places. It is imperative to plant the so-called botanical or species tulips and narcissus in areas with perfect drainage, where it is dry and sunny during the summer.

Soil Preparation

WHILE in most of the spring-flowering bulbs the flower bud is already formed in the bulb at the time it is planted in the fall, it is necessary to prepare the soil well if the bulb is to remain in vigorous con-

dition for several years. Experimentation has proved that fertilizer added to the soil before the bulbs are planted increases growth. The improvement in growth is not evident until the second year when the bulbs that were fertilized at planting time maintain vigorous growth and large flower size, while those not fertilized tend to become smaller and poorer in quality. The two best fertilizer materials are well-rotted manure and a complete commercial fertilizer of the 5-10-5 formula. Use the well-rotted manure at the rate of 5 bushels to 100 square feet of surface area, and work it into the top 8 inches of soil. It is important that the manure be well-rotted, for fresh manure may injure the bulbs. If you use a complete commercial fertilizer of the 5-10-5 or 6-12-6 grade, apply it at the rate of 3 pounds to 100 square feet of surface area and work it thoroughly into the top 8 inches of soil.

Planting

IN some localities where the soil is light and sandy, it is possible to plant bulbs by the dibble method. Make a small hole in the soil with a short-pointed stick, place the bulb in the soil, and after pressing the bulb down into the soil as far as possible cover it with soil. In soils that are rather heavy, it is much better to use a trowel and dig a hole individually for each bulb. It is well to have the soil rather loose underneath the bulb so that the roots can easily penetrate the soil.

Time of Planting

OCTOBER is the best month to plant all of the spring-flowering bulbs. Tulips show some reduction in size of bulb and length of stem when planted after December 1, but any time before December 15 is reasonably satisfactory for them. Narcissi and daffodils are much more tolerant and can be planted until about February 1 without any serious detrimental effects. Planting some time before December 1, however, is more satisfactory.

Depth of Planting

THE depth at which to plant bulbs is important. It has been found that the best depth to plant tulips and narcissi is with the tops of the bulbs 4 inches below the surface of the soil. With narcissi and daffodils it makes considerable difference with the future growth of the bulb, but tulips are somewhat more tolerant of unfavorable depths. In light sandy soils, plant tulips deeper than in heavy soils. With the smaller bulbs, plant the tops about 2 inches below the surface of the soil. Bulbs in this group are scillas, chionodoxas, grape hyacinths, snowdrops, and any of the others that have a diameter of 1 inch or less. For a general rule, the amount of soil above the top of the bulb should be about twice the diameter of the bulb.

Spacing

PLANT the larger growing bulbs, such as tulips and daffodils, about 8 inches apart. This gives the bulbs an opportunity to grow for two or three

years before it is necessary for you to dig and divide them. Plant crocus and grape hyacinths about 4 inches apart. Some of the smaller bulbs, such as winter aconite and scillas, should be placed from 2 to 3 inches apart. If you make a naturalized planting, place narcissi at least 10 inches apart and the small bulbs about 20 to a square foot. Grape hyacinths, scillas, chionodoxas, snowdrops, and other small bulbs are much more effective planted in mass rather than individually.

Rodents

RODENTS of one type or another may injure bulbs during the winter. If you have experienced this difficulty, it is well to take some precaution to guard the bulbs against further injury. If the bulbs are planted in beds, it may be expedient to cover the beds with fine mesh wire and thus prevent mice from digging out the bulbs. Certain repellent materials on the market can be used. As a rule place a small handful of the repellent around the bulb at the time it is planted. You may obtain the material from seed stores or florist shops.

Growth

ASIDE from planting, certain practices affect the growth and development of bulbs over a period of years. Removing the seed pods is important. When the seed pods are left on tulips and narcissi, the new bulbs are much smaller than when the seed pods are removed.

Removing the leaves has just the opposite effect. The more leaves removed from the bulbs when the flowers are cut, the smaller are the new bulbs produced. If the two lower leaves of tulips are left on, they produce new bulbs which are practically normal in weight. Narcissi require from 4 to 6 leaves to produce normal-sized bulbs.

It is well to let the leaves remain on the spring-flowering bulbs until they show signs of ripening and turning yellow. Tulip bulbs usually reach their full development about June 15. Narcissi complete their development about the middle of July. Other types of bulbs vary greatly in the date at which they are mature.

Cut off at the ground level, the foliage of the bulbs when it is fully mature. Remove it from the garden and burn it. Sanitation is one way to control the leaf spot that affects tulips in very wet seasons.

Failure to Bloom

OLD established clumps may not produce flowers because they are overgrown and the bulbs have become too crowded. You may correct this by digging, separating, then resetting the bulbs. If bulbs are dug too soon after flowering, before they are mature, no flowers will develop the next season; but if left in place, will flower the second year. Very small bulbs, especially bulblets separated from large bulbs may not flower simply because they are immature. After two or three years of producing only foliage, they flower normally. Tulips infected with virus ("broken") deteriorate, flowers become smaller in successive years,

and eventually they cease flowering. Destroy such plants and bulbs.

Digging

IT is advisable to dig hardy bulbs and divide the clumps every one to three years. For the maintenance of the best quality bulbs and flowers, it is desirable to dig them every year. If this is inconvenient, you may leave them untouched for three years in succession without seriously decreasing the quality. After three years, you will see a noticeable decline.

In the years bulbs are dug, allow them to mature as long as possible. The last of June or the middle of July lift the bulbs carefully, free them from soil, and remove the tops. You may wash the soil from the bulbs with a hose, and then spread them out in a shady, airy place to allow the surface to dry thoroughly. Then place them in shallow boxes, and store them in a cool, dry, airy place. They are then ready to transplant in the fall. Grade the bulbs, since many of the smaller ones will not produce flowers the following year. Plant only the large sized bulbs in beds or borders. The smaller ones may be planted in rows in a nursery bed and allowed to develop. They will usually form flowering size bulbs in two years.

Broken Tulips

Broken tulips, such as the Rembrandt and bybloom types, should not be planted among the other bulbs. The flower has a variegation or breaking in its color, often of a feathery outline and in no definite pattern. This breaking is the result of a mosaic disease caused by a virus. Other symptoms of the disease are twisted stems, buds that blast, and a yellowish mottling of the foliage. Aphids will transmit this virus to healthy bulbs and eventually your entire bulb planting will be a total loss. As soon as you notice one of these broken tulips, dip up the bulb and discard the entire plant. If you do plant these bizarre types, segregate them in areas isolated from other bulbous material; but it is best not to plant them at all.

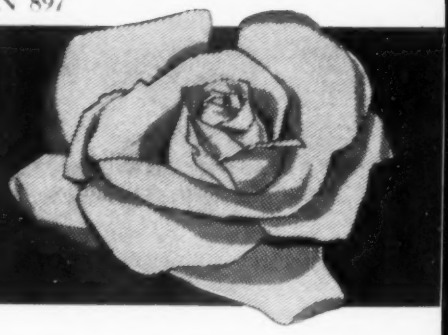
A publication of the
New York State College of Agriculture,
a unit of the State University of New York,
at Cornell University.

Published by the New York State College of Agriculture at Cornell University, Ithaca, New York. L. R. Simons, Director of Extension. Published and distributed in furtherance of the purposes provided for in the Acts of Congress of May 8 and June 30, 1914.

CORNELL EXTENSION BULLETIN 897

The Culture of GARDEN ROSES

R. E. LEE



GARDEN ROSES are of many different types. The *shrub* roses include the *rogosas*, the *sweetbriars*, and many *"species"* roses. These are hardy plants that require little special culture. *Tree* roses (plants budded on an understock standard about 3 feet in height) require special winter protection in New York State and in general are not satisfactory except in areas where winters are mild. *Miniature* or *Tom Thumb* roses are often planted in rock gardens, and require the same care given garden roses. Far more important than any of these are the *hybrid teas, hybrid perpetuals, floribundas*, and the *climbers*. The hybrid teas and the floribundas are the most important garden roses and it is with these that this bulletin is primarily concerned.

Rose plants procured from the nursery may be either on their own roots or budded on some understock. The climbers and shrub types are almost always on their own roots and in fact many varieties may be started easily from cuttings by the amateur. The hybrid teas, hybrid perpetuals, and floribundas are sometimes sold on their own roots and such plants are satisfactory in the mild climates of the Southern States. As a rule, however, they are not satisfactory in New York State where the usual practice is for the nurseryman to sell budded plants grown in the field.

Site

SELECT a site for the rose garden where the plants will receive direct sunlight for about six hours each day. Light shade in the afternoon is an advantage. Be sure, however, not to place the rose garden close to trees with matted surface roots, such as maples, elms, and poplars. This disadvantage can be partly corrected by cutting the tree roots along the edge of the rose bed several times a year. Although roses should not be planted in a dead air pocket with no air circulation, they need some protection from high winds. Hedges, shrub borders, walls, or fences may provide this.

Soil Requirements

ANY good garden soil mixed with peat or other organic matter and well fertilized can produce good roses, provided it is well drained. There is some preference for silty clay or clay loam; the lighter sands should be avoided. The optimum pH value of the soil for roses is between 5.5 and 6.5, which is slightly on the acid side. Very acid or very alkaline soils are unsuitable.

Drainage is of the greatest importance and must be provided on heavy soils that are not well drained. A gentle slope helps to carry off surface water. For subsoil drainage you may use tile or fill trenches with rocks. Be sure such trenches have an outlet away from the rose garden. Relatively deep surface soil is a decided advantage, particularly if it is underlain with heavy clay subsoil.

Prepare the rose bed well by spading to a depth of 12 inches, and working in well-rotted manure if it is available. From 8 to 10 bushels for each 100 square feet of surface area is not too much. Peat, leaf mold, or compost are also satisfactory forms of organic matter. The soil should be well pulverized, and it is a good plan, but not essential, to remove rocks.

Planting

ROSES may be planted either in the fall or in the spring. In severe climates, spring planting is preferable. Plants received from reputable nurseries are packed so that they will stand a week or more from time of shipment without serious damage if kept cool (40° to 50° F). If, however, you cannot set the plants soon after arrival, unpack them and heel them in to prevent drying from winds or sunlight. If the plants seem somewhat dry when unpacked, place the roots in water for a few hours or bury the plants in damp soil, tops and all, for several days.

Plant budded rose plants with the bud union 2 inches below the soil surface. Dig the hole large enough to spread the roots in a natural manner, radiating from the stem like the fingers of a hand. Cover the roots with topsoil and tamp it firmly. Never plant when the soil is so wet that it can be pressed into balls that will not crumble. After the soil is packed firmly about the roots, water the plants thoroughly.

Hybrid teas and vigorous floribundas should be spaced about 2 feet apart, hybrid perpetuals about 3 feet, and climbers at least 5 feet apart.

At the time of planting, shorten back the canes of the hybrid teas and hybrid perpetuals. The diagrams (figure 1) illustrate pruning for spring and fall planting.

Fertilizing

IT is important to keep up the fertility of the rose bed. Well-rotted manure is excellent. Apply it at the rate of 5 bushels to 100 square feet in the spring, and make another application in mid-summer. Apply commercial fertilizer of 5-10-5 or similar formula in the spring when 4 to 6 inches of new growth has been made, and if necessary make a second application about 8 weeks later. Spread the fertilizer over the surface of the bed at the rate of 3 or 4 pounds to 100 square feet, work it into the soil, and water it in. If the weather following fertilization is dry, additional watering is needed.

Mulching

MULCHING the rose bed with granulated peat moss or some other loose material, such as buckwheat hulls, ground corncobs, shredded tobacco stems, sawdust, and the like, is

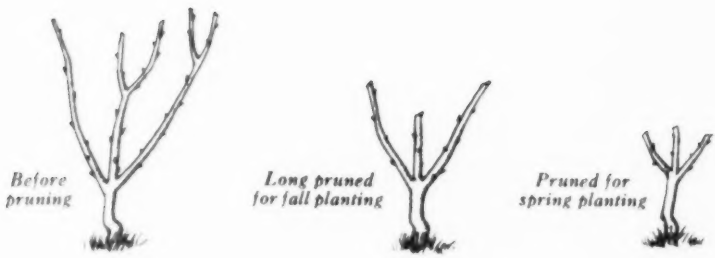


Figure 1. How to prune in fall or spring planting

a satisfactory practice to retain moisture and keep down weeds. Mulching with organic materials may cause a temporary nitrogen deficiency evidenced by yellowing of the rose leaves. Application of a nitrogenous fertilizer will counteract the condition. The mulch should be about 2 inches thick.

Diseases and Insects

DISEASES and insects may be troublesome in the rose garden. The regular use of the so-called "All-Purpose" sprays and dusts containing combinations of fungicides and insecticides is a good preventive measure. A sulfur dust or spray is recommended to counteract *mildew*. The standard practice for the control of *blackspot*, probably the most important disease, is to dust or spray the plants thoroughly every week with a combination of sulfur and ferbam. This prevents infection and protects new foliage before the leaves become infected. Keeping a healthy leaf surface is essential to strong vigorous plants and anything that tends to destroy such leaf surface should be corrected if possible.

In some areas the *Japanese beetle* is a serious pest of roses. A 5 per cent DDT dust helps to control them. Control of these beetles in badly infested areas is discussed in Cornell Extension Bulletin 770. *Rose chafers, leafhoppers, thrips,* and *rose midge* may be serious pests against which DDT is effective. *Aphids* are controlled by using a nicotine sulfate spray. If unrecognized diseases or insects become a problem, consult the Department of Plant Pathology or the Department of Entomology at Cornell University.

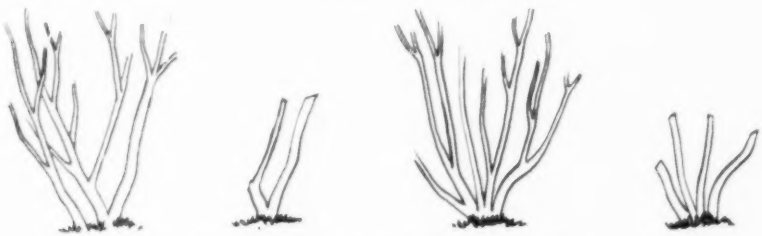


Figure 2. Hybrid tea roses before and after pruning. The more vigorous the bush, the more wood is left

Winter Protection

In New York State winter protection is necessary for hybrid teas and in many seasons is an advantage with hybrid perpetuals and floribundas. No method has been devised better than mounding soil around the base of each plant to a height of 10 or 12 inches. Do this in late fall after the first hard frost. If plants are spaced far enough apart, you may bring the soil from between the plants and heap it about the plants, then remove it in the spring. Level the mounded soil back in place in late March or early April when danger of serious freezing weather has passed.

In regions where climbers suffer winterkilling, lay the canes on the ground and mound soil over the base of the plants. It may be necessary to hold down the canes at the base with stakes. Cover the canes lying on the ground with earth or some mulching material. If the plants are next to lawn areas, laying the canes in the grass is a good practice.

Either dig and bury rose trees in a trench over winter or leave them in place and wrap them with sheaves of straw kept in place with burlap. Be sure to protect the bud union.

Pruning

PRUNE the *climbing* and *pillar roses* in midsummer just after the blooms have faded. At this time cut off close to the roots the old canes that have produced flowers. New canes for next year's bloom will be several feet long at this time. Do not break or bruise these new canes in the pruning process. Some semi-climbing varieties, such as Dr. Van Fleet and the climbing hybrid teas and climbing floribundas, should have only the older flowering wood removed, leaving the more vigorous shoots which originated in previous years as well as the new canes coming from the base.

Hybrid teas, hybrid perpetuals, and *floribundas* are pruned in the spring after all danger from winter injury is past. Remove all dead winterkilled canes. It is also advisable to cut out weak and spindly growth which is smaller than a lead pencil in diameter, provided there are two or three more vigorous canes left. Prune back the remaining canes to a point below which no winter injury is evident. (Figure 2.)

During the summer little pruning is needed. In cutting flowers, leave at least two nodes at the base of each flowering shoot.

Just before the plants are mounded with earth for winter protection, shorten the vigorous canes so that they will not whip about in the wind. After a few years, experience will tell you the average amount of winter killing to expect, and you can cut the canes back to that point in the tall.

The *hybrid perpetuals* are somewhat more vigorous than the hybrid teas. They are pruned in much the same way, but wherever possible more green wood is left to produce flowers. If canes have come through the winter undamaged, they may be left 2 or 3 feet high.

Floribunda roses require little pruning except to remove old wood and to shorten back some of the canes for the first season.

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